

APPARATUS CLAIMS

1. A variable impedance prosthesis or orthosis, comprising:
 - a. A proximal end for interfacing to a user;
 - 5 b. a distal end for interfacing to the environment;
 - c. a stiffness controller;
 - d. a controllable-spring-rate spring element.
2. The apparatus of claim 1, wherein said controllable-stiffness spring element comprises multiple parallel interlockable spring elements.
- 10 3. The apparatus of claim 1, wherein said controllable-stiffness spring element comprises a spring element with a variable mechanical advantage.
4. The apparatus of claim 1, wherein said controllable-stiffness spring element comprises multiple parallel valved pneumatic spring elements.
5. The apparatus of claim 1, wherein said controllable-stiffness spring
15 element comprises a spring element and a parallel powered mechanical force source.
6. The apparatus of claim 1, wherein said controllable-stiffness spring element comprises a spring element and a series powered mechanical displacement source.
- 20 7. The apparatus of claim 1, wherein said controllable-spring-rate spring element further comprises:
 - a. a first spring element disposed between said proximal end and said distal end;
 - b. a mechanical energy storage element;
 - 25 c. a controllable power source configured to store energy in said energy storage element;

- d. a controllable coupling between said energy storage element and said first spring element;
- e. a controller configured to control timing and rate of power output of said controllable mechanical power source, and coupling of controllable coupling.

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8. The apparatus of claim 7, wherein said controllable mechanical power source comprises a muscle and a controllable mechanical coupling between said muscle and said energy storage element

10 METHOD CLAIMS

9. A method for providing variable mechanical impedance in a prosthetic or orthotic, comprising varying the spring rate a controllable-spring-rate spring automatically with a spring-rate controller as a function of a repeated cycle of use of said prosthetic or orthotic.

15 10. The method of claim 9, wherein said variable-spring-rate spring comprises multiple parallel interlockable spring elements, and said controller controls the interlocking of said elements.

11. The method of claim 9, wherein said variable-spring-rate spring further comprises a first spring and an energy storage element, and further
20 comprising:

- a. storing energy from a power source in said energy storage element during a first span of time;
- b. releasing energy from said energy storage element in the form of mechanical work displacing a proximal end of a prosthesis from a distal end of said prosthesis or orthosis during a second span of time.

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